Response to Arguments

1. Applicant's arguments, see (Remarks 12/18/2007, page 2, 1st paragraph), with respect to claim 26 have been fully considered and are persuasive. The 35 USC/1st paragraph rejection of claim 26 has been withdrawn.

2. Applicant's arguments filed 12/18/2007 & 1/25/2008 have been fully considered but they are not persuasive.

a) Argument: Applicant has stated: (a) "Examiner argues that Feuerstein discloses the N transmit signals ... " (Remarks 12/18/2007, page 2, last paragraph) (b) Examiner contradicts himself by saying in fact Feuerstein does not disclose N transmit antennas (Remarks 12/18/2007, page 3, 1st paragraph).

Response: Examiner respectfully disagrees. What Feuerstein discloses is N transmit signals that are fed to the antenna elements 401 (Fig. 4) to provide beams (column 5, lines 19 - 21). Though Feuerstein states that the antenna elements are physically separate (column 6, lines 10 – 19), he does not explicitly state that the antenna elements are a separate antennas. Examiner is using Lundby for the separate antennas. As stated in the last Office Action (CTNF 7/18/2008); page 3, 2nd bullet; page 7), Feuerstein can be used to weight and combine the main and delayed signals, which can then be fed to Lundby's multiple antennas.

b) Argument: Applicant has stated "why route each main signal to each switch matrix only to set the weight to zero on al but one switch matrix" (Remarks 12/18/2007, page 3, 2nd paragraph, 1st few lines)

Response: What Feuerstein discloses is the most general combination. One of ordinary skill in the rat can easily set the appropriate weight in the switch matrix top arrive at Applicant's invention.

c) Argument: Applicant has stated there in no antenna diversity in Lundby

Response: Examiner respectfully disagrees. Lundby clearly states that his invention uses antenna diversity (column 4, lines 16 – 19, 37 – 46).

d) Argument: Applicant has stated "delaying and weighting according to Feuerstein and then feeding the signals to the antennas instead of antenna elements, would not result in the claimed invention (Remarks 12/18/1007; page 4, 2nd paragraph).

Response: Examiner respectfully disagrees. One of ordinary skill in the art can easily feed the signals to separate antennas instead of antenna elements to result in the claimed invention.

e) Argument: Applicant has stated Feuerstein does not disclose a system in which N transmit signals ... because the antenna beams are substantially non-overlapping to avoid destructive combining" (Remarks 1/25/2008; page 4, last few lines of 3rd paragraph).

Response: Feuerstein's method is very general. One of ordinary skill in the art can select the weights appropriately to avoid the non-overlapping.

f) Argument: Applicant has stated that there is more than one main signal being transmitted per transmit signal (Remarks 1/25/2008; Page 5, 2nd paragraph).

Response: Examiner respectfully disagrees. As shown in Fig. 6, Feuerstein feed all main and all delayed main signals to each switch matrix. In the switch matrix, one of ordinary skill in the art can easily set the weighting such that only one main signal is present per transmit signal.

g) Argument: Applicant has stated that there is "no desirability of the claimed invention in the references that would serve as a reason for skilled in the art to combine references (Remarks 1/25/2008; page 6, 2nd paragraph).

Response: As stated in bullet a) above, one of ordinary skill in the art can easily use Feuerstein's method to weight and combine the main and delayed signals, which can then be fed to Lundby's multiple antennas. Feuerstein can be used to weight and combine the main and delayed signals, which can then be fed to Lundby's multiple antennas.

h) Argument: Applicant has stated that in Feuerstein, multiple beams transmitted to a common receiver would result in destructive combining of the beams (Remarks 1/25/2008, page 6, last few lines of middle paragraph and last paragraph)

Response: See bullet e) above.

i) Argument: Applicant has stated that McGuffin only discloses down converting, amplifying and synchronously detecting a signal on each antenna and that no “pre-combined" signals are disclosed (Remarks 1/25/2008; page 8, last paragraph - page 9, 1^{st} 2 lines).

Response: Examiner respectfully disagrees. As stated by the Applicant in his specification (page 44, line 22 - page 45, line 18) and shown in Applicant's Fig. 12, the "pre-combined" signals are the outputs of elements 237 and 243 i.e. "pre-combined" signals are the outputs after processing in the two paths. McGuffin discloses multiple paths from the antennas 2a – 2m (Fig 1), the outputs of which can be fed to a MIMO detector. Therefore, Examiner is interpreting the outputs of the paths shown in McGuffin as the “pre-combined” signals.

j) Argument: Applicant has stated that "the manner in which the individual references cited by the Examiner have been combined does not allow for proper interdependence of the limitations”.

Response: Examiner respectfully disagrees. Feuerstein and Lundby disclose how the transmitted signals are generated (e.g. see bullet a), b) and d)). For the receiver side, McGuffin discloses a receiver with multiple antennas, Hilton discloses how each received signal can be split into a plurality of streams and Lundby discloses processing the plurality of streams using the MIMO decoder.

k) <u>Argument</u>: Applicant has stated Rudrapatna discloses processing of data from T receive antennas and not pre-combined signals (Remarks 1/25/2008, page 10, last paragraph – page 11, 1st paragraph).

l) <u>Response</u>: Though Rudrapatna discloses the input to the MIMO decoder as being from the antennas, one of ordinary skill in the art can easily use the pre-combined signals as the inputs in place of the antenna inputs. As Applicant has himself admitted (Remarks 12/18/2007, page 2, 1st paragraph) "once a set of signals has been identified for processing, may ways of performing MIMO processing are available to those skilled in the art". Therefore it is not inconceivable that one of ordinary skill in the art can use the pre-combine signals as the inputs to Rudrapatna's MIMO decoder.

For the above reasons Examiner has maintained his rejection as in the last Office Action.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1, 6, 7, 10, 11, 13, 31, 32, 36, 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528).

Regarding claim 1, Feuerstein discloses a transmitter (Fig. 6; column 1, lines 25 - 29) comprising:

the N transmit signals collectively comprise a plurality N of main signals (Fig. 6, elements α , β , γ) and a plurality of delayed main signals each delayed main signal being a delayed version of one of the main signals (Fig. 6, outputs of elements 621, 622, 623; column 7, lines 15 – 40; wherein the delayed signals are the outputs of the delay elements 621, 622, 623 that are fed to elements 651, 652, 662 to produce the beams 1, 2 ..12), wherein each transmit signal comprises a combination of only a respective main signal of the plurality of N main signals and at least one respective delayed main signal of the plurality of delayed main signals (Fig. 6, elements 651, 652, 662 outputs; column 7, lines 1 - 56, wherein the outputs are obtained by combining the main signal with the delayed signals, the combination being provided by the switch matrices whose weights can be adjusted to give only one main signal per beam).

Feuerstein does not disclose N transmit antennas where N>=2.

In the same field of endeavor, however, Lundby discloses N transmit antennas (N >=2) with each transmit antenna for transmitting a respective one of N transmit signals to a common receiver (Fig. 1).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow the advantages of antenna diversity to be taken advantage of (column 4, lines 16 – 25).

Regarding claim 6, Feuerstein discloses:

a first delay element for delaying the first main signal $S_A(t)$ to produce a first delayed signal S_A (t-D1) where D1 is a first delay (Fig. 6, element 621; column 7, lines 15 – 26; wherein the delay is element 621);

a second delay element for delaying the second main signal S_B (t) to produce a second delayed signal S_B (t-D2) where D2 is a second delay (Fig. 6, element 622; column 7, lines 15 – 26; wherein the delay is element 622);

wherein a first linear combination of one of the main signals and one of the delayed signals is transmitted and a second linear combination of the other of the main signals and the other of the delayed signals is transmitted (Fig. 6, outputs of elements 651, 652; column 7, lines 15 – 55; wherein the first and second linear combinations are provided by the switch matrices 651 and 652 which can be programmed by the controller 670 to provide the desired linear combination and then these beams are fed to Lundby' 1stand 2nd antennas).

In the same field of endeavor, however, Lundby discloses a transmitter for transmitting a first main signal SA(t) and a second main signal SB(t) (Fig. 2, signals in upper and lower paths), the transmitter comprising:

a first antenna and a second antenna (Fig. 2, elements 4, 6; column 7, lines 26 – 44).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow the advantages of antenna diversity to be taken advantage of (column 4, lines 16 – 25).

Regarding claim 7, Feuerstein discloses the first main signal and the second main signal are each CDMA (Code Division Multiple Access) signals (Title; Abstract; column 12, lines 19 – 22).

Regarding claim 10, Feuerstein does not disclose scrambling the first and second main signals.

In the same field of endeavor, however, Lundby discloses a scrambling circuit for scrambling a first signal to produce the first main signal and for scrambling a second signal to produce the second main signal, the first signal and the second signal being scrambled with an identical scrambling code (Fig. 2, elements 116, 118; column 6, lines 15 – 20; column 7, lines 18 – 21; wherein the scrambling circuits are the PN circuits 116 and 118. Lundby does not explicitly state what the spreading codes are and therefore Examiner has taken the broadest interpretation and assumed that they could be equal

or different. In column 7, lines 26 – 44, Lundby states that the signals in the path could be distinguished from each other by using the delay element. Therefore, using the same PN in each path would not prevent the receiver from distinguishing the two paths).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow the signal in the two channels to be distinguished from each other, as disclosed by Lundby.

Claim 11 is similarly analyzed as claim 10.

Regarding claim 13, Feuerstein does not disclose a demultiplexer for splitting the symbols into two streams.

In the same field of endeavor, however, Lundby discloses a demultiplexer for splitting a symbol stream into symbols included in said first signal and said second signal (Fig. 2, element 104; column 5, line 66 – column 6, line 3).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow the signal to be transmitted by multiple antennas, as disclosed by Lundby (Fig. 2).

Regarding claim 31, Feuerstein discloses the transmitter (Fig. 6).

Feuerstein does not disclose a receiver and atleast one receive antenna.

In the same field of endeavor, however, Lundby discloses a receiver comprising at least one receive antenna (Fig. 3, element 200), each receive antenna receiving a respective receive signal over the wireless channel from the transmitter (Fig. 3, element 200) receive signal processing circuitry adapted to process the receive signals (Fig. 3, element 207 - 224).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow the signal to be received, processed and decoded, as is well known in the art.

Claim 32 is similarly analyzed as clam 31 with the searcher in the receiver capable of detecting the main signal and the delayed signals.

Regarding claim 36, Feuerstein discloses a transmitter (Fig. 6);

a first delay element for delaying the first main signal $S_A(t)$ to produce a first delayed signal S_A (t-D1) where D1 is a first delay (Fig. 6, element 621; column 7, lines 15 – 26; wherein the delay is element 621);

a second delay element for delaying the second main signal S_B (t) to produce a second delayed signal S_B (t-D2) where D2 is a second delay (Fig. 6, element 622; column 7, lines 15 – 26; wherein the delay is element 622);

wherein a first linear combination of one of the main signals and one of the delayed signals is transmitted and a second linear combination of the other of the main signals

and the other of the delayed signals is transmitted (Fig. 6, outputs of elements 651, 652; column 7, lines 15 – 55; wherein the first and second linear combinations are provided by the switch matrices 651 and 652 which can be programmed by the controller 670 to provide the desired linear combination).

The limitation regarding the first main signal, second main signal, first antenna and second antenna is as analyzed in claim 6 above.

Claim 48 is similarly analyzed as the corresponding limitation in claim 1.

5. Claims 2, 3, 33, 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of Harrison (US 6.067,324) and Alamouiti (A Simple Transmit Diversity Technique for Wireless Communications; October 1988; IEEE Journal on Select Areas in Communications; pages 1451 – 158).

Regarding claim 2, Feuerstein discloses Transmit_J comprises:

$$\text{Transmit}_J = (S_J) + \sum_{i=1}^{K} (S_{iJ}(t - D_{iJ}))$$

S_J=is the J^{th} main signal of the plurality of main signals;

α_J = is a virtual spatial reflector applied to the J^{th} main signal;

T_J = is a transformation applied to the J^{th} main signal;

K_J = is a number of delayed signals included in the J^{th} transmit signal;

α_{iJ} = is a virtual spatial reflector applied to the i^{th} delayed signal included in the J^{th} transmit signal;

S_{iJ}, $i=1, \ldots, K_J$ are the signals which are to be delayed and included in the J^{th} transmit signal where each $iJ \in 1, \ldots, N$;

D_{iJ} = is a delay applied to signal S_{iJ};

T_{iJ} = is a transformation applied to the i^{th} delayed signal included in the J^{th} transmit signal.

(Fig. 6, column 7, lines 1 – 56; wherein for example if J = 1, then the signal S_1 would be the main signal in beam 1 which is the α signal and the delayed signals would be the signals β_D and γ_D. The switch matrix can be set to select the appropriate signals that comprise each beam).

Feuerstein does not disclose that the signals are transmitted from one of multiple antennas, main and delayed signals are scaled and a transformation.

In the same field of endeavor, however, Lundby discloses the N transmit signals comprise a J^{th} transmit signal $Transmit_J$ from antenna $J=1, \ldots, N$, (Fig. 2, element 4, 6).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow the advantages of antenna diversity to be taken advantage of (column 4, lines 16 – 25).

In the same field of endeavor, however, Harrison discloses a gain scaling that can be applied to each path (Fig. 5, element 306; column 6, lines 44 – 48).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Harrison, in the system of Feuerstein because this would allow the spectrum to be shaped, as is well known to one of ordinary skill in the art or also control the transmitted power, as disclosed by Harrison (column 3, lines 45 – 47).

It is noted that the applicant has stated that an example of the transformation operation is a conjugation operation (specification, page 28, lines 20 - 23) and therefore the examiner has interpreted the transformation operation to be a conjugation operation.

In the same field of endeavor, Alamouiti discloses a transformation that is performed on the input signal (page 1453, right column, 1st paragraph).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Alamouiti, in the system of Feuerstein because this would provide better performance than a system with no diversity, as disclosed by Alamouiti (page 1455, Fig. 4).

Regarding claim 3, Feuerstein discloses each transmit signal comprises a CDMA (Code Division Multiple Access) signal (Title; Abstract; column 12, lines 19 - 22).

Claim 33 is similarly analyzed as claim 2.

Claim 34 is similarly analyzed as claim 3.

6. Claim 4, 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of Harrison (US 6.067,324), Alamouiti (A Simple Transmit Diversity Technique for Wireless Communications; October 1988; IEEE Journal on Select Areas in Communications; pages 1451 – 158).

Regarding claim 4, Feuerstein does not disclose that each main signal comprises a respective combined set of at least one code separated channel.

In the same field of endeavor, Lundby discloses each main signal comprises a respective combined set of at least one code separated channel (Fig. 2, elements 116, 118; column 6, lines 15 – 20; column 7, lines 18 – 21; wherein the code separated channel is interpreted as being obtained by the PN spreading code).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would separate a channel from other channels, thereby allowing detection of a channel on the receiver side, as is well known in the art.

Claim 35 is similarly analyzed as claim 4.

7. Claims 8, 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of Harrison (US 6.067,324).

Regarding claim 8, Feuerstein discloses the first linear combination comprises:

$$X_A(t) = \quad S_A(t) + \quad S_A(t - D1)$$

and the second linear combination comprises:

$$X_B(t) = \quad S_B(t) + \quad S_B(t - D2)$$

(Fig. 6, outputs of switch matrices 651, 652, 662, controller 670; column 7, lines 15 – 56; wherein the linear combinations are obtained by having the controller set the switch matrices appropriately).

and that a resulting channel matrix H yields a well conditioned H*H for a particular noise environment where D1 and D2 are delays and where H* is the complex conjugate of H (Abstract, column 1, lines 25 – 29; column 2, line 66 – column 3, line 13; It is well known to one of ordinary skill in the art that a well conditioned spectrum has no nulls while an ill-conditioned spectrum has deep nulls. Therefore, having a well-conditioned matrix is equivalent to avoiding deep nulls in the spectrum).

Feuerstein does not disclose the scale factors that are used for the linear combination.

In the same field of endeavor, however, Harrison discloses a scale factors that can be applied to each path (Fig. 5, element 306; column 6, lines 44 – 48).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Harrison, in the system of Feuerstein because this would allow the spectrum to be shaped, as is well known to one of ordinary skill in the art or also control the transmitted power, as disclosed by Harrison (column 3, lines 45 – 47).

Claim 9 is similarly analyzed as claim 8, with the controller again setting the switch matrices to give the appropriate linear combination.

8. Claims 12, 21 - 23, 27, 37, 38, 44, 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of McGuffin (US 4,217,586).

Regarding claim 12, Feuerstein does not disclose that the delay is selected so that there is enough separation between the scrambling codes in the main and delayed paths.

In the same field of endeavor, however, McGuffin discloses each delay implemented in one of the delay elements is selected to provide enough separation between the scrambling code and a version of the scrambling code delayed by the delay such that

the scrambling code and the scrambling code delayed by the delay are substantially orthogonal to each other (column 6, lines 49 – 53).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by McGuffin, in the system of Feuerstein because this would allow the two PN codes to be resolvable and uncorrelated, as disclosed by McGuffin.

Regarding claim 21, Feuerstein does not disclose less than N receive antennas.

In the same field of endeavor, however, Lundby discloses there are less than N receive antennas (Fig. 3, element 200; wherein less than N is interpreted a single antenna).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow a single antenna to be used, thereby simplifying receiver complexity.

Claim 22, 27, 37, 38, 44, 45 are similarly analyzed as claim 21.

Regarding claim 23, Feuerstein discloses that all signals are CDMA (Code Division Multiple Access) signals (Title; Abstract; column 12, lines 19 – 22).

9. Claims 5, 14, 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of Applicant Admitted Prior Art (hereafter referred to as AAPA).

Regarding claim 5, Feuerstein does not disclose each transmit signal comprises atleast one code separated signal combined with one main signal.

Applicant had admitted in the specification (Fig. 2) that such signals are combined (see Fig. 2, inputs to element 526; specification, page 8, line 4+).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by AAPA, in the system of Feuerstein because this would allow multiple types of channel to be transmitted simultaneously, as disclosed by AAPA.

Regarding claim 14, Feuerstein discloses a CDMA system (Title; Abstract; column 12, lines 19 – 22).

Feuerstein does not disclose code-separated channels that are generic, user specific and are used for main signals.

Applicant had admitted in the specification (Fig. 2, element 501; specification, page 21, lines 3 – 4; page 8, lines 4 – 22) that the typical conventional CDMA transmitter has a respective first set of at least one channels which are generic to multiple users; a respective second set of at least one channels which are user specific; and a respective third set of channels which are user specific and which function as one of said main signals.

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by AAPA, in the system of

Feuerstein because this would allow multiple types of channel to be transmitted simultaneously, as disclosed by AAPA.

Regarding claim 41, Feuerstein does not disclose transmitting and receiving OFDM.

Applicant had shown in the specification (Fig. 3; specification, page 21, lines 5 - 6;) a conventional OFDM transmitter and receiver.

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by AAPA, in the system of Feuerstein because this would allow the benefits of OFDM, namely resistance to multipath, data rate adaptation to SNR etc to be taken advantage of.,

10. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of El-Gamal et al. (US 20020131516).

Regarding claim 15, Feuerstein does not disclose that the first and second main signals are OFDM signals.

In the same field of endeavor, however, El-Gamal discloses the first main signal and the second main signal are each OFDM (Orthogonal Frequency Division Modulation) signals (Fig. 2, element 211 207; page 3, paragraph 32, last 4 lines in particular; page 7, paragraph 78, 1st 4 line sin particular).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by El-Gamal, in the system of Feuerstein because this would allow antenna diversity to be used for an OFDM system.

11. Claims 16, 17, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) and further in view of Lundby et al. (US 6,356,528), Harrison (US 6.067,324 and El-Gamal et al. (US 20020131516).

Regarding claim 16, Feuerstein discloses the first linear combination comprises:

$$X_A(t) = \quad S_A(t) + \quad S_A(t-D1)$$

and the second linear combination comprises:

$$X_B(t) = \quad S_B(t) + \quad S_B(t-D2)$$

(Fig. 6, outputs of switch matrices 651, 652, 662, controller 670; column 7, lines 15 – 56; wherein the linear combinations are obtained by having the controller set the switch matrices appropriately).

and that a resulting channel matrix H yields a well conditioned H*H for a particular noise environment where D1 and D2 are delays and where H* is the complex conjugate of H

(Abstract, column 1, lines 25 – 29; column 2, line 66 – column 3, line 13; It is well known to one of ordinary skill in the art that a well conditioned spectrum has no nulls while an ill-conditioned spectrum has deep nulls. Therefore, having a well-conditioned matrix is equivalent to avoiding deep nulls in the spectrum).

Feuerstein does not disclose the scale factors that are used for the linear combination.

In the same field of endeavor, however, Harrison discloses a scale factors that can be applied to each path (Fig. 5, element 306; column 6, lines 44 – 48).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Harrison, in the system of Feuerstein because this would allow the spectrum to be shaped, as is well known to one of ordinary skill in the art or also control the transmitted power, as disclosed by Harrison (column 3, lines 45 – 47).

Claim 17 is similarly analyzed as claim 16.

Regarding claim 19, Feuerstein discloses there in no large notch in the spectrum (Abstract, column 1, lines 25 – 29; column 2, line 66 – column 3, line 13).

Feuerstein does not disclose the scaling factors.

In the same field of endeavor, however, Harrison discloses a gain scaling that can be applied to each path (Fig. 5, element 306; column 6, lines 44 – 48).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Harrison, in the system of Feuerstein because this would allow the spectrum to be shaped, as is well known to one of ordinary skill in the art or also control the transmitted power, as disclosed by Harrison (column 3, lines 45 – 47).

12. Claim 18, 42 is rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of Applicant Admitted Prior Art (AAPA) and El-Gamal et al. (US 20020131516).

Regarding claim 18, Feuerstein does not disclose a forward error correction block, symbol mapping, demultiplexing, and IFFTs.

Applicant had admitted in the specification (Fig. 3, OFDM transmitter 100; specification, page 21, lines 5 – 6) that the prior art discloses a forward error correction block for performing forward error correction on an incoming bit stream to generate a coded bit stream (Fig. 3, channel coding 104);

a symbol mapping function for mapping the coded bit stream to a first modulation symbol stream (Fig. 3, symbol mapper 106);

a first IFFT (Inverse Fast Fourier Transform) function (Fig. 3, IFFT 110), first prefix adding function and first windowing filter (Fig. 3, element 114) adapted to process the second modulation symbol stream to generate the first main signal (Fig. 3, element 120);

a second IFFT (Inverse Fast Fourier Transform) function, second prefix adding function and second windowing filter adapted to process the third modulation symbol stream to generate the second main signal (the second IFFT and subsequent processing is same as disclosed for the first IFFT but is used on the second stream obtained from the demultiplexer).

AAPA does not disclose a demultiplexing function.

In the same field of endeavor, however, Lundby discloses a demultiplexing function adapted to divide the modulation symbol stream into second and third modulation symbol streams (Fig. 2, element 104; column 5, line 66 – column 6, line 3).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow the signal to be transmitted by multiple antennas, as disclosed by Lundby (Fig. 2).

Claim 42 is similarly analyzed as claim 18.

13. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view McGuffin (US 4,217,586).

Regarding claim 20, Feuerstein discloses a signal transmitted over a wireless channel from a transmitter (Fig. 4);

the N transmit signals collectively containing a plurality N of main signals (Fig. 6, elements α , β , γ) and a plurality of delayed main signals each delayed main signal being a delayed version of one of the main signals (Fig. 6, outputs of elements 621, 622, 623; column 7, lines 15 – 40; wherein the delayed signals are the outputs of the delay elements 621, 622, 623 that are fed to elements 651, 652, 662 to produce the beams 1, 2 ..12), wherein each transmit signal comprises a combination of a respective main signal of the plurality of main signals and at least one respective delayed main signal of the N delayed main signals (Fig. 6, elements 651, 652, 662 outputs; column 7, lines 1 - 56, wherein the outputs are obtained by combining the main signal with the delayed signals, the combination being provided by the switch matrices and the transmit signals are the beams that are fed to the transmit antennas in Lundby's system).

Feuerstein does not disclose multiple transmit antennas, a receiver with atleast one antenna and receive processing circuitry.

In the same field of endeavor, however, Lundby discloses a plurality N of transmit antennas (Fig. 2; column 5, lines 19 – 40), wherein the transmitter is adapted to transmit a respective one of N transmit signals from each of the N antennas (Fig. 1, 2).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of

Feuerstein because this would allow the advantages of antenna diversity to be taken advantage of (column 4, lines 16 – 25).

In the same field of endeavor, however, McGuffin discloses a receiver for receiving a signal transmitted over a wireless channel (Fig. 1) , the receiver comprising: at least one receive antenna (Fig. 1, elements 2a, 2b, ...2m), each receive antenna receiving a respective receive signal over the wireless channel from the transmitter; receive signal processing circuitry adapted to perform receive processing for each of the N main signals and each of the N delayed main signals (Fig. 1, elements 6a-m, 10a-m, 11a-m).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by McGuffin, in the system of Feuerstein because this would allow the signal to be received by multiple antennas, thereby improving the receiver performance through antenna diversity, as is well known in the art.

14. Claims 24, 25, 39, 40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of McGuffin (US 4,217,586) and Easton (US 5,764,687).

Regarding claim 24, Feuerstein does not disclose a finger detector.

In the same field of endeavor, however, Easton discloses a finger detector configured to process each receive signal to identify multi-path components transmitted by each antenna, the multi-path components comprising at least one pair of multi-path components comprising a first multi-path component and a second multi-path component which is later than the first multi-path component by the delay introduced at the transmitter (Fig. 2, elements 12, 14; column 5, lines 16 – 26; wherein the finger detector is interpreted as the searcher that can detect any delay that is also introduced by the transmitter).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Easton, in the system of Feuerstein because this would allow multipath components to be detected, as is well known in the art.

Regarding claim 25, Feuerstein does not disclose that the receiver does dispreading and descrambling and an array processor.

In the same field of endeavor, however, Easton discloses the receive signal processing circuitry comprises de-scrambling and de-spreading functions which produce de-spread signals for each multi-path component (Fig. 3, elements 100, 106; column 9, lines 38 – 45; column 12,lines 50 - 61), the receiver further comprising: a virtual array processor for performing combining of the de-spread signals (column 6, line 66 – column 7, line 14; column 22, lines 32 – 33; wherein the array processor is interpreted as being done by the digital signal processor).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Easton, in the system of Feuerstein because this would allow the channel to be properly decoded, as is well known in the art.

Claim 39 is similarly analyzed as claim 24.

Claim 40 is similarly analyzed as claim 25.

15. Claims 26 - 30, 43, 46 – 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of McGuffin (US 4,217,586) and Hilton (US 20030080890).

Regarding claim 26, Feuerstein discloses Feuerstein discloses a signal transmitted over a wireless channel (Fig. 4, Abstract);
N transmit signals (Fig. 6, elements beam1, beam 2, ...) wherein the transmit signals are the beams 1 ...12), the N transmit signals collectively containing a plurality N of main signals (Fig. 6, elements α , β , γ) and a plurality of delayed main signals each delayed main signal being a delayed version of one of the main signals (Fig. 6, outputs of elements 621, 622, 623; column 7, lines 15 – 40; wherein the delayed signals are the outputs of the delay elements 621, 622, 623 that are fed to elements 651, 652, 662 to produce the beams 1, 2 ..12), wherein each transmit signal comprises a combination of a respective main signal of the plurality of main signals and at least one respective

delayed main signal of the N delayed main signals (Fig. 6, elements 651, 652, 662 outputs; column 7, lines 1 - 56, wherein the outputs are obtained by combining the main signal with the delayed signals, the combination being provided by the switch matrices).

Feuerstein does not disclose multiple transmit antennas, a receiver with atleast one antenna and receive processing circuitry, an over sampling ADC, and a MIMO decoder.

In the same field of endeavor, however, Lundby discloses a plurality N of transmit antennas (Fig. 2; column 5, lines 19 – 40), wherein the transmitter is adapted to transmit a respective one of N transmit signals from each of the N antennas (Fig. 1, 2);

a MIMO (Multiple Input Multiple Output) decoder adapted to perform MIMO processing on the pre-combined signals (Fig. 3, elements 220 and 222; column 8, lines 22 – 34; wherein the MIMO decoder is interpreted as the combined elements 220 and 222, which receive the multiple and produce a single stream. Also see Response to Arguments above).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow the advantages of antenna diversity to be taken advantage of (column 4, lines 16 – 25) and the received signal to be decoded, as is well known in the art.

In the same field of endeavor, however, McGuffin discloses a receiver for receiving a signal transmitted over a wireless channel (Fig. 1), the receiver comprising: at least one

receive antenna (Fig. 1, elements 2a, 2b, ...2m), each receive antenna receiving a respective receive signal over the wireless channel from the transmitter;

signal processing circuitry adapted to perform receive processing for each of the sample streams to produce pre-combined signals (Fig. 1, elements 6a-m, 10a-m, 11a –m);

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by McGuffin, in the system of Feuerstein because this would allow the signal to be received by multiple antennas, thereby improving the receiver performance through antenna diversity, as is well known in the art.

In the same field of endeavor, however, Hilton discloses each receive antenna, a respective over-sampling analog to digital converter which samples the respective receive signal and a respective sample selector adapted to produce a respective plurality of sample streams (Fig. 3; paragraph 18. Another method: Fig. 2; paragraph 17; also see response to Arguments (2nd last bullet).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Hilton, in the system of Feuerstein because this would reduce the effects of aliasing , as is well known in the art.

Regarding claim 27, Feuerstein does not disclose less than N receive antennas.

In the same field of endeavor, however, Lundby discloses there are less than N receive antennas (Fig. 3, element 200; wherein less than N is interpreted a single antenna).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow a single antenna to be used, thereby simplifying receiver complexity.

Claim 28 is similarly analyzed as claim 27.

Regarding claim 29, Feuerstein discloses each transmit signal comprises a main signal and N-1 delayed signals (Fig. 6, elements 611 – 651; wherein the delayed signals are generated by delay elements 621, 622, 623).

Feuerstein does not disclose that each over sampling converter performs N times over sampling

In the same field of endeavor, however, Hilton discloses each over-sampling analog to digital converter performs N times over-sampling (Fig. 2, element 220, 230; page 2, paragraph 17; wherein the N times over sampling is interpreted as two times over sampling).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Hilton, in the system of Feuerstein because this would allow would reduce the effects of aliasing, as is well known in the art.

Claim 30 is similarly analyzed as claim 29, with the ADC having two times over sampling to generate two streams.

Claim 43 is similarly analyzed as the corresponding limitation in claim 26.

Claim 46 is similarly analyzed as claim 29.
Claim 47 is similarly analyzed as claim 30.

Examiner is including a second rejection for claim 26, especially for the last limitation in which the MIMO decoder is rejected using Rudrapatna et al. (EP 1313246 A1).

16. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of McGuffin (US 4,217,586), Hilton (US 20030080890) and Rudrapatna et al. (EP 1313246 A1).

Regarding claim 26, Feuerstein discloses Feuerstein discloses a signal transmitted over a wireless channel (Fig. 4, Abstract);
N transmit signals (Fig. 6, elements beam1, beam 2, ...) wherein the transmit signals are the beams 1 ...12), the N transmit signals collectively containing a plurality N of main signals (Fig. 6, elements α , β , γ) and a plurality of delayed main signals each delayed main signal being a delayed version of one of the main signals (Fig. 6, outputs of elements 621, 622, 623; column 7, lines 15 – 40; wherein the delayed signals are the

outputs of the delay elements 621, 622, 623 that are fed to elements 651, 652, 662 to produce the beams 1, 2 ..12), wherein each transmit signal comprises a combination of a respective main signal of the plurality of main signals and at least one respective delayed main signal of the N delayed main signals (Fig. 6, elements 651, 652, 662 outputs; column 7, lines 1 - 56, wherein the outputs are obtained by combining the main signal with the delayed signals, the combination being provided by the switch matrices).

Feuerstein does not disclose multiple transmit antennas, a receiver with atleast one antenna and receive processing circuitry, an over sampling ADC, and a MIMO decoder.

In the same field of endeavor, however, Lundby discloses a plurality N of transmit antennas (Fig. 2; column 5, lines 19 – 40), wherein the transmitter is adapted to transmit a respective one of N transmit signals from each of the N antennas (Fig. 1, 2);

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow the advantages of antenna diversity to be taken advantage of (column 4, lines 16 – 25).

In the same field of endeavor, however, McGuffin discloses a receiver for receiving a signal transmitted over a wireless channel (Fig. 1), the receiver comprising: at least one receive antenna (Fig. 1, elements 2a, 2b, ...2m), each receive antenna receiving a respective receive signal over the wireless channel from the transmitter;

signal processing circuitry adapted to perform receive processing for each of the sample streams to produce pre-combined signals (Fig. 1, elements 6a-m, 10a-m, 11a –m);

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by McGuffin, in the system of Feuerstein because this would allow the signal to be received by multiple antennas, thereby improving the receiver performance through antenna diversity, as is well known in the art.

In the same field of endeavor, however, Hilton discloses each receive antenna, a respective over-sampling analog to digital converter which samples the respective receive signal and a respective sample selector adapted to produce a respective plurality of sample streams (Fig. 3; paragraph 18. Another method: Fig. 2; paragraph 17; also see response to Arguments (2^{nd} last bullet).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Hilton, in the system of Feuerstein because this would reduce the effects of aliasing , as is well known in the art.

In the same field of endeavor, however, Rudrapatna discloses a MIMO (Multiple Input Multiple Output) decoder adapted to perform MIMO processing on the pre-combined signals (Fig. 2. element 20; Abstract; paragraph 12; Also see Response to Arguments above: bullet (I)).

17. Claim 49 is rejected under 35 U.S.C. 103(a) as being unpatentable over Feuerstein (US 6,178,333) in view of Lundby et al. (US 6,356,528) and further in view of Baker (US 20020173302).

Regarding claim 49, Feuerstein does not disclose a single receive antenna and producing two signals from the single received signal.

In the same field of endeavor, however, Lundby discloses at a single receive antenna, receiving over a wireless channel a received signal (Fig. 3, element 200).

Therefore it would have been obvious to one having ordinary skill in the art, at the time the invention was made, to use the method, as taught by Lundby, in the system of Feuerstein because this would allow a single antenna to be used, thereby simplifying receiver complexity.

In the same field of endeavor, however, Baker discloses processing the received signal to produce at least two signals which are mathematically equivalent to two signals which would be received over two different receive antennas; processing the two signals as if they were received over two different antennas (page 4, paragraph 53; Fig. 4; wherein the processing as if received on two antenna is done as shown in Fig. 4).

Other Prior Art Cited

18. The prior art made of record and not relied upon is considered pertinent to the applicant's disclosure.

The following patents are cited to further show the state of the art with respect to antenna diversity techniques:

Raleigh et al. (US 6,144,711) discloses use of spatio-temporal processing for communication.

Raleigh (US 6,377,631) discloses a transmitter incorporating spatio-temporal processing.

Kelkar et al. (US 20020064246) discloses Spatial-temporal methods and systems for reception of non-line-of-sight communication signals.

Briley (US 6,456,610) discloses a TDM/TDMA wireless telecommunication system with electronic scanning antenna.

Conclusion

19. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Contact Information

20. Any inquiry concerning this communication or earlier communications from the examiner should be directed to ADOLF DSOUZA whose telephone number is (571)272-1043. The examiner can normally be reached on Monday through Friday from 8:00 AM to 5:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Payne can be reached on 571-272-3024. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Adolf DSouza
Examiner
Art Unit 2611

AD

/David C. Payne/

Supervisory Patent Examiner, Art Unit 2611